Project: *Information Access*

Last update: 30 September 2005

Project Objectives

1. Provide software tools that enable development of assistive instructional software applications for visually impaired K-12 students.
2. Utilize a combination of graphing, sonification, and mathematical analysis software to represent mathematical and scientific information.
3. Provide unique, NASA-technology teaching tools that enhance STEM education for visually impaired students.

Customers

1. Vision impaired high school math and science students and their teachers.
2. Sighted high school math and science students and their teachers.
3. Blind, visually impaired and sighted researchers seeking information from complex, scientific data.
4. Software developers wishing to integrate and/or extend IAL library components to add accessibility to graphing applications.
5. Curriculum developers wishing to incorporate multi-mode, accessible technology into math, science and special needs education.

Use Cases

1. Teachers use the IAL to instruct vision-impaired as well as sighted high school students in mathematics and science concepts.
2. Researchers model mathematical equations and raw data using IAL as a means of visualization.
3. Application developers incorporate IAL components to provide alternative representations of data, formulae and concepts.

People

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Partnerships

- National Federation of the Blind (NFB) (http://www.nfb.org)
- Southeast Regional Clearinghouse (SERCH) (http://serch.cofc.edu/serch) Special Needs Group
- Texas School for the Blind and Vision Impaired (TSBVI) (http://www.tsbvi.edu)

Deliverables and Schedule

- 15 Nov 2004 – Annual performance plan complete

- 5 Jan 2005 - IAL software refocused on customer base to demonstrate and document applicability to specific classroom use, grade level and audience
- 31 Mar 2005 - IAL interface simplified based on user feedback, professional consultation with educational associates and domain expert evaluation
- 31 Mar 2005 - IAL documentation complete including curriculum/grade level use and benefit
- 30 June 2005 - Sonification upgrades in place
- 30 June 2005 - JSC Education Officer Review of IAL
- 30 Sep 2005 - IAL integrated with two independently developed educational applications or curriculum

Dependencies

- Continuation of the above partnerships.

Assumptions

- A segment of the IAL user demographic will utilize a JAVA™ capable screen reader technology such as JAWS™ (http://www.freedomscientific.com) to relay aural information.

Accomplishments

1. 15 November 2004 – Annual Performance Plan delivered.
2. 5 January 2005 - IAL software refocused on customer base to demonstrate and document applicability to specific classroom use, grade level and audience.
3. 1 February – Began contacts with legal and other necessary organizations to plan for open-source release.
4. 28 February 2005 – Much significant feedback collected on IAL applications and the IAL web site.
5. 4 March 2005 - IAL interface simplified based on user feedback, professional consultation with educational associates and domain expert evaluation. (Work on track to completion of 31 Mar deliverable.)
6. 30 June 2005 – Sonification upgrades implemented and working well.
7. 30 June 2005 – IAL review by site Education Officer initiated.
8. 30 September 2005 – Project has completed all requirements and deliverables.

Deployment and Evaluation Planning

Customer Focus

The IAL software responds to a need in the blind education community for high school math and science teaching tools. The IAL makes math problems accessible to the vision-impaired in the same way that graphing calculators serve sighted students. It uses text descriptions combined with stereo sound to express math relationships. The accessible IAL software significantly expands the learning medium for blind high school students, enabling them to increase their math and science understanding and improve their proficiency in these subjects. IAL provides an additional modality for sighted high school students to improve their spatial reasoning skills and understand how math is applied in real world situations.

Content

The IAL software can analyze math equations and model different types of NASA data such as rocket launches, ozone change, cloud base predictions, radiative transfer, air and sea interactions, rainfall distribution, ecosystem changes, the expansion of space, solar activity, solar wind, adaptations to microgravity or space radiation. A specific example of using the IAL with NASA content is showcased by the National Federation of the Blind summer camp, Rocket On!, in which blind high school students used the software to generate predictions for acceleration, drag, range, altitude, angle and velocity of a rocket as functions of time. The students used the simulation data to plan the mission just as NASA scientists do. Following the experiment, they analyzed data files containing actual performance and payload data and compared it with their predictions. IAL technology has the potential to make NASA data-based education products accessible to a very large, and previously underserved audience.

Pipeline

The IAL significantly contributes to NASA's mission of exposing and engaging K-12 students in STEM activities. It particularly contributes to the education of blind high school students who might otherwise be unaware of NASA programs and available STEM career opportunities. The IAL is a teaching tool that provides blind students with the kind of technology needed to learn science and math. The coupling of the IAL with important NASA research such as rocketry, earth, space and biomedical sciences will potentially motivate blind students to seek fulfilling STEM careers as part of the NASA workforce or other technical profession. IAL tools provide a conduit to other NASA educational activities.

Diversity

The IAL project reaches blind high school students that, at present, are an underrepresented, underserved and underutilized student demographic. STEM careers are typically in fields that value mental prowess over physical ability so the blind student community represents an enormous, untapped reservoir of candidates for technical careers. Built by, for and in collaboration with persons in the blind community, the IAL provides an accessible science and math instruction tool for high school students with vision disabilities. Special needs experts indicate that IAL tools are applicable to other student populations such as ADD/ADHD students.

Evaluation

The overall IAL project evaluation goals are defined in the Annual Performance Plan as maintained by the LT project office. The IAL team solicits evaluative input from educational associates, interface designers, domain experts, the NLT review committee and the blind community. Our major collaborators provide additional evaluative input regarding IAL performance and usability.

Partnership & Sustainability

The JSC LT team is currently in partnership with the National Federation of the Blind (NFB) and the NASA Space Science brokerage Southeast Research ClearingHouse (SERCH). Discussions are underway for collaborative activities with the NASA Student Observation Network (SON), the Sun-Earth Connection program, and the space science Education/Public Outreach (E/PO) segments of the SWIMM and Moonrise missions.

The NFB Jernigan Institute leads the quest to develop innovative education resources, technologies, products and services that help the world's blind achieve independence. The Information Access Lab directly supports each key initiative set forth in the mission statement of the Jernigan Institute (http://www.nfb.org/nfbrti/about.htm). IAL was selected for the inaugural youth activity -- the "Rocket On!" science camp, a collaboration among NFB, NASA Goddard/Wallops and the JSC LT team. The IAL software was included on CDs distributed to Rocket On! participants and is under continuous review as a key component of this program.

The Southeast Regional Clearinghouse (SERCH) <http://serch.cofc.edu> is a member of the NASA Office of Space Science Broker/Facilitator Network. SERCH, through the Exceptional Needs Working Group (ENWG), is a leader in dissemination and adaptation of NASA science information to educators of students with special needs. ENWG sponsors a major conference every summer, and the IAL has been featured in each of the past two years. JSC LT will provide the keynote speech at the conference again in July of 05.

IAL has been included in an internal proposal to the Goddard Center Director to incorporate IAL technology into software that supports the SON activity Radio Jove <http://son.nasa.gov/tass/radiowaves/from_stu.htm> The Student Observation Network <http://son.nasa.gov/> is a combination of four on-line student programs where students are part of a national network of classrooms learning about space weather, its effects, solar storms and how to predict auroral events. The SON modules provide tutorials to help understand the scientific data and step-by-step guides to using the data.

Potential collaboration points include E/PO components of two upcoming space science missions -- Selenographic Water, Ice and Mineralogy Mapper (SWIMM) and the Moonrise lunar robotic sample return mission.

IAL will seek additional partnerships/collaborations to increase dissemination, use, curriculum integration, independent evaluation and product sustainability. Potential partners include specialists in assistive technology, educational technology education, math and science education, special needs education, graphing software and NASA math and data-based education projects.

Actions in Response to the NLT Annual Project Review

- Demonstrate and document applicability to specific classroom use, grade level and audience
- Simplify interface based on user feedback and professional consultation with educational associates
- Document software including curriculum/grade level use and benefit
- Upgrade sonification features

Continuation Plan

The main components of the continuation plan are:

- Provide the software to the open source community.

- To attempt to arrange funded collaborations with major organizations supporting the special needs learning community.

The IAL technology will be maintained and supported by the JSC LT team and disseminated to the Center for Educational Technology, the National Federation of the Blind, and the Southwest Regional Clearing House. Additionally, JSC LT has proposals pending with several organizations, and the specifics of any future activities will incorporate the outcome of these awards.